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Hygiene and Safety Practices of Food Vendors

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Abstract

The objective of this paper was to examine the extent to which food vendors at a university in KwaZulu-Natal practice both hygiene and safety in their dispensing practices. Using mixed methods, structured questionnaires were developed for managers and food handlers with individual observation studies that were conducted for each handling structure. Findings demonstrate that food vendors lack the knowledge of proper hygiene and safety. Salient issues include poor infrastructure and limited access to tap water resulting in food handler's hands seldom being washed hygienically. Inadequate storage facilities resulted in stock overflowing to countertops and floors whilst food being prepared was exposed to dust and flying insects due to vending structures being in open air. The risks associated with minimum sanitation promotes cross contamination and foodborne illnesses. Whilst there are many studies conducted on food vendors however, limited research is available regarding hygiene and safety of vended foods in South Africa, more especially food vendors supplying higher education institutions. Therefore, this paper contributes to literature pertaining to hygiene and safety practice of food vendors that supply staff and students at universities.

Keywords: Food vendors; hygiene; safety practice; universities; cross contamination

Introduction

Food vendors are categorised as informal traders as they are small, often unlicensed and untrained in food hygiene and sanitation (Hill, 2016; Lamin-Boima, 2017; Rathod 2017). They are a major employer in the informal sector that contributes significantly to South Africa's Gross Domestic Product (GDP) (Gamieldien & van Niekerk, 2017; Hill, Mchiza, Puoane & Steyn, 2019). However, the issue of sanitary quality is crucial whereby hygiene and food safety has increasingly become a concern due to the health risks and the number of people that die annually from foodborne illnesses (Cortese, Veiros, Feldman & Cavalli, 2015; Iwu, Uwakwe, Duru, Diwe, Chineke, Merenu, Oluoha, Madubueze, Ndukwu & Ohale, 2017; Trafialek, Drosinos, Laskowski, Jakubowska-Gawlik, Tzamalis, Leksawasdi, Surawang & Kolanowski, 2018). In addition, the new threat presented by Covid-19 has forced all industries to change their behaviour and to adopt effective hygiene and safety measures (Jameel & Faiz, 2020; Li, Hallsworth & Coca-Stefaniak, 2020). Thus, making food vendors a significant concern given their reputation of poor hygiene and safety (Alamo-Tonelada & Bildan, 2018; Hill, 2016;

Trafialek et al., 2018) and considering they are subjected to poor facilities and limited access to hygienic water (Cortese et al., 2015).

Globally street food supplies a significant number of people in the cities, particularly in developing countries, for example Dhaka, Mumbai, Calcutta, Delhi; Bangkok, Mexico, Malaysia, Vietnam (Alamo-Tonelada, Silaran & Bildan, 2018). South Africa has shared in this international phenomenon where up to 4 million people consume food outside their home including street food (Nyoni & Bonga, 2019). As urban populations are growing along with food industry worldwide, street food and food vending will continue to expand and being a convenient quick meal (Samapundo, Climat, Xhaferi & Devlieghere, 2015). Street food in South Africa was considered reasonably safe however, the conditions under which food vendors operate are often unacceptable for the purposes of preparing and selling food. Therefore, there is a need for proper hygiene practices, access to sanitary facilities and clean running water (Hill, 2016; Samapundo et al., 2015). Furthermore, during the Covid-19 pandemic it is imperative that hands and surfaces are washed and sanitised regularly to prevent the spread of the virus. Several studies have been conducted in relation to hygiene and safety and food vendors for example, in Nigeria (Isara, Osagie, Omodamwen & Omorodion, 2017; Iwu et al., 2017; Okojie & Isah, 2019) Ethiopia (Adana, Teke, Gismu, Halefom & Ademe, 2018), India (Mukherjee, Mondal, De, Misra & Pal, 2018) Ghana (Amaami, Dominic & Collins, 2017) and Brazil (Cortese et al., 2015) providing the generalisation that food vendors have poor levels of food safety knowledge. Additionally, there is a paucity of studies that assess the hygiene and food safety practises of food vendors at tertiary institutions in South Africa.

Therefore, this paper aims to address the literature gaps by assessing the hygiene knowledge and food safety practise of food vendors at Durban University of Technology (DUT) in KwaZulu – Natal. This study seeks to present the food vending practices of food vendors along the peripheral area of the four campuses of DUT including the relevant findings that are associated with poor sanitation.

Literature review

Street food vending

The term “street vendor” in English is used interchangeably with “street trader”, “hawker” or “retailer” and is used to describe all the people marketing products and services to the community without a secured or proper vending structure (Rathod, 2017). Food vendors are described as people selling ready-to-eat foods and beverages in the streets or other public places and are regarded as informal workers (Hill, 2016; Nemo, Bacha & Ketema, 2017; Samapundo et al., 2015). The trading place for food vendors range to a number of vicinities including train stations, bus and taxi terminals, schools, hospitals, universities, pavements and festival areas (Hill, 2016; Rathod, 2017; Sezgin & Şanlier, 2016; Tadesse, Mitiku, Teklemariam & Marami, 2019; Tesfaya, Yohannes, Melese & Henok, 2016).

The South African food vendors range from food including sandwiches, potato chips, boerewors rolls, hot dogs (sausage on rolls) burgers, schwarmas, salads, pies, fat cakes (deep – fried bread dough shaped in balls), snacks and a variety of fizzy drinks, fruit juices, water (Hill et al., 2019), and are popular favourites that sell nearby tertiary institutions. There is a paucity of hygiene and food safety studies regarding food vendors in South Africa (Table 1). One of the studies conducted in the last decade by Kok and Balkaran (2014) which sought the implications for consumers in central Durban Transport Exchange, revealed a number of unhygienic conditions observed in the area. These authors found that cooking equipment was washed in containers and big pots that were later used for cooking food whilst water used for washing dishes in the containers was used repeatedly since water was not available nearby.

Table 1. Similar Food Safety Knowledge and Hygiene studies of Food Vendors conducted in South Africa from (2002 – 2020)

Author and Reference	Study Population	Measuring Instruments	Summarised results	Destination
Lues, J.F.R., Rasephei, M.R. Venter, P. & Theron, M.M. 2006. Assessing food safety and associated food handling practices in street food vending	45 randomly selected vendors located in the Central Business District and in various townships in the city of Bloemfontein	Questionnaire and checklist were used in interviews.	The overall microbiological quality of the foods served by the street vendors was found to be within acceptable safety limits, although the presence of specific microorganisms such as Escherichia coli, Staphylococcus aureus, Salmonella and yeasts is indicative of a degree of ignorance on the part of the food handlers towards proper hygienic practices.	City of Bloemfontein
Campbell, P.T. 2011. Assessing the knowledge, attitudes and practices of street food vendors in the city of Johannesburg regarding food hygiene and safety.	Certified street food vendors selling cooked foods in the City of Johannesburg. The targeted study sample was 378 rounded to 400, but due to practical reasons, and other operational factors, only 150 street vendors were recruited	Interviews with street food vendors to collect data on knowledge and attitudes. Observation checklist to collect data on practices related to food hygiene and safety.	The results revealed that in general street food vendors were knowledgeable on the principles of ensuring safe food. It was also noted that there was a significant statistical difference between the street food vendors that were trained and those that did not have any training.	City of Johannesburg
Kok, R. & Balkaran, R. 2014. Street food vending and hygiene practices and implications for consumers.	29 street vendors were observed within the largest transport exchange in the city of Durban.	No interviews or questionnaires, only the observation sheet.	The researcher discovered that street vendors have the knowledge of food safety and hygiene. However, the knowledge of food safety and basic hygiene practices need to be improved.	City of Durban
Mjoka, J. & Selepe, M. 2017 Food hygiene practices and attitudes of the street food vendors at KwaDlangezwa, Northern KwaZulu Natal	Purposive sampling was used because of the knowledge of the number of food vendors in the area of KwaDlangezwa.	Interview questionnaires and an observation schedule and it was collected in the form of face-to-face communications.	Very few of the vendors in this study acknowledged that it was important to store food at its correct temperature to prevent spoilage and some of them said improper storage of food may be hazardous to health. This calls for the urgent training on hygiene practices and food safety of street vendors and governmental support at the local levels.	KwaDlangezwa, Northern KwaZulu Natal

Kok and Balkaran (2014) further indicated that unclean dishes and pots were kept next to the serving areas, and that attracted flies in the area, refuse bins were left open promoting insects and rodents, and prepared food was not appropriately covered exposing it to dust and humid temperatures. Street-vended foods were commonly perceived to be hazardous, of poor quality, and a major public health threat due to the lack of basic infrastructure where food vendors operate (Samapundo et al., 2015; Sezgin & Şanlier, 2016). Other researchers have argued that food sold by food vendors may be a leading public health hazard from bacterial contamination and poor handling practices that could lead to foodborne illnesses which drastically hinders community health and socio-economic development (Iwu et al., 2017; Nemo et al., 2017; Trafialek et al., 2018).

The unemployment rate in South Africa has affected Black African women considerably more than their male counterparts resulting in the majority of the street traders being black women, who are destitute and at the lower level of the socio-economic ladder (Hill, 2016). Thus, street food handlers are not educated and require knowledge in safe food handling and sanitation (Hill, 2016; Rathod, 2017). However, regardless of all the noticeable unhygienic conditions, customers continued to patron the food vendors indicating that affordability superseded issues of hygiene and safety.

South Africa's ratio of street food vendors is higher than the number of non-food vendors (Hill, 2016) implying that South Africa's high unemployment rate of 29.0% (Department Statistics South Africa, 2019) might be the contributor to the latter. Due to the lack of recent research on street-vendors in South Africa, the literature on the economic impact of the street-vendors is mainly based on research done in 2006 by von Holy and Makhoane. Moreover, food vendors contribute considerably to the economy of the country and has emerged as a profitable activity and a great source of income for the underprivileged (Gamieldien & van Niekerk, 2017). As a result, massive garbage piles up contributes a habitat for insects, animals and pests around the trading sites. Food is then exposed to dust, flies and

safe food storage temperatures and correct holding temperatures are hard to maintain (Sezgin & Şanlier, 2016).

Table 2. Related Food Safety and Hygiene studies conducted within an education context

Author and Reference	Study Population	Measuring Instruments	Summarised results	Destination
Afolaranmi, T.O., Hassan, Z.I., Misari, Z., Dan, E.E., Judith, O.C., Kubiat, N.N., Mohammed, A. & Akosu, T.J. 2017. Food Safety and Hygiene Practices among Food Vendorsin Tertiary Hospitals Inplateau State Nigeria	87 food vendors in food vending premises within the four tertiary health institutions in Platemi state Nigeria.	Interviewer administered questionnaire.	The level of practice of food safety and hygiene requires improvement as wholesomeness and utmost safety of food is essential to promoting and preserving health.	Plateau state - Nigeria
Akabanda, F., Hlortsi, E.H. and Owusu-Kwarteng J. 2017. Food safety knowledge, attitudes and practices of institutional food-handlers in Ghana	29 institutions, two hundred and thirty-five (235) institutional food-handlers.	Face to face interviews and administration of questionnaire.	In generally, the institutional food-handlers have satisfactory knowledge in food safety but this does not translate into strict hygienic practices during processing and handling food products.	Ghana
Odo, A.N. & Onoh, S.C. 2018. Food Hygiene Knowledge and Practices among Food Handlers in University of Nigeria, Nsukka Campus	165 food handlers	Questionnaire was used.	There was no significant difference in the food hygiene practices of food handlers based on level of education. The study recommended among others, that managers of food business establishments should frequently supervise the hygienic condition under which food handlers working for them prepare food.	Nigeria
Effect of Health Education on Food Hygiene Practices and Personal Hygiene Practices of Food Vendors in Public Secondary Schools at Oshimili South Local Government Area	54 food vendors used for the study was gotten from the school food vending registers of the various schools.	A researcher-developed questionnaire and observation checklist for Pre-test and Post-test.	The food vendors' hygiene practices were still poor despite some notable improvement after the health education intervention. It is therefore recommended that School management should ensure that the food vendors are regularly trained on proper food handling and teachers are also delegated to monitor the food vendors during sales at break time.	Delta State - Nigeria
Food hygiene practices of food vendors in secondary schools in Ilorin	185 respondents recruited using inclusion and exclusion criteria.	Pre-tested questionnaire and observational checklist.	Unkempt fingernails, skin lesions and poor food protection from flies were some of the food contaminating risk factors observed in the study. The need exists for food vendors and other food handlers to be trained on basic principles of safe food handling.	Nigeria

Similarly, there is a scarcity of studies that have been conducted regarding food safety and hygiene of food vendors within an education context. However, it is evident from Table 2 that none of the studies have been conducted within South Africa. Whilst food safety and hygiene may be of interest, research of this nature lacks from a food vendor perspective as well as within the context of higher education institutions particularly in South Africa.

Food-borne illnesses

Researchers Adam, Hiamey and Afenyo (2014) noted that public eating-places have been implicated with most of the cases relating to mishandling food and dirty environment. These authors further stipulate that food that is prepared and sold on university campuses are not well monitored especially in developing countries where either health authorities are not implementing the rules or the food regulating bodies do not exist (Adam et al., 2014). As a result, the absence of these bodies may have health implications on consumers considering that 70% of bacterial food poisoning incidences are caused by caterers (Adam et al., 2014; Annor & Baiden, 2011).

South Africa has numerous foodborne epidemics affecting mostly children at school, but there is shortage of resources to trace all the cases. As a result, research has signified that ongoing investigations are required to assess the outbreaks of foodborne diseases and halt the outburst from escalating (Bisholo, Ghuman & Haffejee, 2018). Studies between 2013 and 2017 in South Africa reveals that there were 327 foodborne diseases epidemics that were reported during the summer seasons. Notably, KwaZulu-Natal had the highest percentage of 43%

followed by Gauteng and Mpumalanga with 19% and 12% respectively (Shonhiwa, Ntshoe, Essel, Thomas & McCarthy, 2019).

Ensuring food safety and good hygiene practice is among the toughest challenges the food vendors face every day. The lack of basic infrastructure such as shelter, water and sanitation exposes food sellers to poor health and conditions (Gamieldien & van Niekerk, 2017). Whilst the world is facing the widespread of Covid-19 and part of curbing the spread of the virus, government implemented lockdown rules and regulations, which had catastrophic impact on the livelihoods of the street vendors. Most of the street vendors work in crowded places therefore, social distancing is impossible in overcrowded areas. Most of the vending sites still have no access to water hence washing of hands and effective sanitation regularly is virtually impossible.

Standards and requirements for food premises in South Africa

There is a specific policy outlined by the South African Department of Health (2012) that food vendors should abide by. For example, food sites need to be well positioned, designed and built without causing any health risks. A complete guideline for these standards and requirements are stipulated on the South African Department of Health website.

Functions of the manager of the food site

The South African Department of Health (2012) advises that every site manager responsible for organizing food preparation; ensuring the food site is rodent free, free of garbage, clean and tidy garbage storage area, washing and fumigation of garbage containers and a working waste water discarding system. Moreover, the manager needs to guarantee that food handlers attend food hygiene training courses, and inform and document any diseases to the health inspector. The person in charge also needs to ensure that food handlers do not wear excessive jewellery that might contaminate food, and food preparation areas are not used as rest rooms or clothes washing areas (South African Department of Health, 2012).

Duties of the food handler

The South African Department of Health (2012) further asserts that food handlers need to safeguard against any acts that might cause food adulteration or food wastage. Thus, the South African Department of Health (2012) set out a thorough instruction list that is found on their website.

Methods to improve food vendors' practices

Studies conducted in different countries around the world on food safety knowledge reveals that extensive training on hygienic handling of food is essential (Has, Jaafar & Chilek, 2018; Husain, Manan, Jamil & Hanafi, 2016). Training prior to fulltime employment and re-assessment training for all food vendors should be compulsory before food vendors are issued with a permit to trade (Sibisi, 2018). Furthermore, essential infrastructure such as decent food stalls with proper facilities for cooking, storage, washing and garbage removal is needed to offer healthy and safe food to customers (Dudeja, Gupta & Minhas, 2016). A study by Mjoka and Selepe (2018) suggest that food handlers should be coached and observed to conform to thorough hand washing, satisfactory cleaning and effective hygiene practices to minimize the risk of cross-contamination.

Research methods

Design and sampling

This study employed a mixed method approach with the use of questionnaires and observation studies (Alamo-Tonelada et al., 2018; Cortese et al., 2015; Hill, 2016; Trafialek et al., 2018) in order to collect relevant data for the purpose of locating the hygiene and safety practises of food vendors. With the use of a quantitative method, individual questionnaires were borrowed from existing studies (Meaker, 2008; Campbell, 2011) with written consent via email and subsequently adapted for this study. This was followed by a qualitative approach with an intensive observation study that was conducted with a modified observation sheet borrowed from Meaker (2008).

DUT has a total of 16 food-vending stalls across the four campuses. This study purposely selected all vendors selling food items that were prepared and served on site. Out of these 16 food vendors, one was excluded from the sample size due to not meeting the qualifying criteria of food items being prepared or cooked in the stall. That brought the total number of vendors who participated in the study to 15 (Table 3).

Table 3. Sampling table

Campus 1 (Ritson Road)	**Campus 2** ML Sultan Campus	**Campus 3** (City Campus)	**Campus 4** Steve Biko Campus	**Total**
1 Food Stall	1 Food Stall	1 Food Stall	12 Food Stalls	15 Food Stalls
1 Manager	1 Manager	1 Manager	12 Managers	15 Questionnaires
3 Food Handlers	8 Food Handlers	1 Food Handler	27 Food Handlers	39 Questionnaires
1 Observation study	1 Observation study	1 Observation study	12 Observation study	15 Observations

Being limited to a single higher education institution, prompted that all three instruments to be lengthy, comprehensive and carefully designed to ensure maximum use of the questionnaires, observation sheets and sample size. Table 3 further illustrates the total sample size of questionnaires (54) and observation studies (15) respectively.

Data collection

Consent from the Institutional Research Committee (IREC) was secured to conduct the study at the university since the food vendors were appointed by the institution. Ethical clearance was also approved (Ethics number 078/13) by the Institutional Research Ethics Committee (IREC) in conjunction with the Human Sciences Research Council (HSRC) guidelines. Preceding approval the targeted managers of food vending stalls were approached to discuss the study including the methodological approaches and obtained further consent respectively. Individual consent forms were signed by all respondents on the day of data collection.

The borrowed and adapted existing structured questionnaires for both management and food handler's encompassed five sections that emanated from the literature which underpinned the study. For example, food safety and hygiene (Cortese et al., 2015; Iwu et al., 2017; Trafialek et al., 2018), food storage and food preparation (Dudeja et al., 2016; South African Department of Health, 2012), food holding, serving and waste (South African Department of Health, 2012), training and food safety (Hill, 2016; Lamin-Boima, 2017; Rathod, 2017; Sibisi, 2018), food safety and hygiene knowledge (Has et al., 2018; Husain et al., 2016; Kok & Balkaran, 2014). Both questionnaires also included a general biographical section.

Each questionnaire was administered in the English language and if the respondents required a translation, a Zulu translation was offered to provide a better understanding whilst the questionnaire was completed for both managers and food handlers alike. Questionnaires were administered and completed outside the kitchens or vending stalls which took 20 minutes to complete individually. Managers and food handlers answered separate questionnaires however, containing the similar five sections to establish the similarity of the responses

between the manager/owner and the food handlers in each stall. The targeted sample was confined to a local area and therefore, each structured questionnaire was personally administered on a one and one basis. This allowed for all questionnaires to be completed effectively in a short period of time.

Observation study

Subsequent to the completion of all structured questionnaires, the observation study was conducted for each stall. The observation process started from 8h00 of which managers and food handlers were greeted and their routine was thus observed which took up to 8 hours due to the intensity of the checklist. The observation sheet contained similar sections (general management of food stalls; storage; food preparation; holding and serving; wastage and hygiene practices) adapted from Meaker (2008) and Louw, Bekker and Wentzel-Viljoen (2001). Each question was answered by circling or ticking a "Yes" or "No" or "N/A" where suitable. Therefore, a full working day was spent at each stall to monitor food handler's and the management conduct towards the food preparation process. The observation sheet was only completed once and all data collection transpired over two months.

Data Analysis

Before leaving each food vendor, all manager's questionnaire, food handler's questionnaire and the observation checklist were checked for completeness to avoid unusable data. Thus, all questionnaires and observation checklist data were captured on an Excel spreadsheet and uploaded to the statistical software known as the Statistical Package for the Social Sciences (SPSS) version 21.0 for descriptive data analysis. Various themes were formulated and analysed from both quantitative and qualitative responses under the respective themes presented in the instruments. Comparisons were drawn between the answers provided by managers and food handlers where questions overlapped on the two questionnaires. In addition, data from the observation studies are reported descriptively to further assess if responses from the questionnaires correlated with the practise of hygiene and safety during service.

Results and discussions

Demographic characteristics of respondents (Managers)

The respondent rate of study was 100% since all the targeted personnel participated. The socio-demographic results were grouped according to personal information, level of education, length of business, and work experience. All the respondents 100.00% (n=15) were owners of the business and were 30 years of age and older. Typically, 66.67% (n=10) of the business owners were women with matric / Grade 12 as the highest level of education. Studies conducted in Nigeria, Brazil, Thailand, Cameroon and South Africa (Danikuu, Baguo & Azipala, 2015; Hill et al., 2019; Samapundo et al., 2015) demonstrated similar results in terms of level of education. Only 6.67% (n=1) had a post matric qualification and these findings were comparable to the study done in Cape Town (Hill et al., 2018) and 20.00% (n=3) achieved a standard 6-9/ Grade 8-11 qualification. Danikuu et al., (2015) believe that formal education plays an important role in stimulating a good understanding and practice of personal and food hygiene by food handlers. Furthermore, additional research suggest that women are more involved in food preparation and serving, and this is largely influenced by cultural orientation (Kannan, Sparks, Webster, Krishnakumar & Lumeng, 2009; Ma, Chen, Yan, Wu & Zhang, 2019).

The majority of the respondents 80.00% (n=12) were in the food vending business for more than three years, and 80.00% (n=12) of the owners had hired four or more staff members. Out of the 15 managers who participated in the study, only 26.67% (n=4) did not have work experience in the food service industry. The other 73.33% (n=11) worked in food

establishments either preparing or serving food. Correspondingly, the study conducted in Johannesburg yielded similar results where the larger percentage (47.00%) of vendors had three years and more of vending experience (Campbell, 2011).

Demographic characteristics of respondents (food handlers FH's)

The socio-demographic results of FH's were assembled in the following categories: number of employees, duration of employment and work experience. The number of FH's employed varied according to the size of the vending facilities with eight (20.51%) being the highest number in one vending stall and two (5.13%) being the lowest number of FH's. Only 6 (15.38%) FH's were employed for less than a year, and the rest ranged from two years to 10 years. The majority of FH's 21 (53.85%) had prior experience in food service. Work experience results complemented those of the managers, since the statistics revealed that the majority of both parties had previous experience in food service (Campbell, 2011).

Basic infrastructure

Forty percent of the vendors obtained running water from the kitchen taps while 60.00% did not have water on site and they obtained water from a communal sink tap situated a few meters from the food stalls. Related studies mirrored these conditions for example in Cape Town (Hill et al., 2019), Haiti (Samapundo et al., 2015) & China (Ma et al., 2019).

Hot and cold water were available from the communal sink and water for food preparation and washing of hands was collected by buckets or containers. All the dishes and utensils used during food preparation and serving were washed outside in the communal sink. However, non-existence of sinks and tap water within the stalls encourage recycling of dirty water as pointed out by several studies (Kok & Balkaran, 2014; Muyanga, Nagiya, Namagumya & Nasinyama, 2011). Likewise, in a study conducted on food vendors in Northern KwaZulu Natal, draws on the fact that shortage of running water from taps results in vendors storing water under exposed conditions that may lead to contamination and foodborne illness (Mjoka & Selepe, 2017). Furthermore, most of these structures had electricity and 80% of the vendors used electricity when preparing food and the rest 20% used gas stoves.

Food safety and hygiene knowledge

The majority of the respondents seem to have good food safety knowledge as illustrated in Table 4. Food safety questions received a 100.00% response rate from both the managers and the FH's. These revelations are in line with the results of the study in Haiti which concluded that street vendors in South Africa and the Philippines exhibit decent/appropriate food safety awareness (Samapundo et al., 2015). While knowledge on prevention of cross contamination through frequent hand washing during food preparation and separating raw and cooked food also received a good response rate of 100.00% from both parties, the statistics indicate that both the parties (managers 33.33% (n=5) and FH's 46.15% (n=18) were uninformed that chopping boards could cause cross-contamination. If the knife is not washed in between tasks, the chances of cross-contamination are extremely high. Related studies suggest that basic food hygiene training can ensure that food vendors practice proper hygiene and sanitation rules (Chukuezi, 2010; Mjoka & Selepe, 2017).

Food temperature control before serving received a positive response of 100.00% (n=15) and 92.31% (n=36) respectively, however the majority of managers and FH's (60.00% (n=9) and 58.97% (n=23) respectively incorrectly answered that food can be thawed on the counter. These findings indicate that the respondents were not knowledgeable on the rules and regulations regarding the thawing of food, implying poor knowledge food safety (Chukuezi, 2010; Mjoka & Selepe, 2017). Both managers and FH's (60.00% (n=9) and 69.23%

(n=27) alike incorrectly believed that clean water is visible and no need for testing to ensure cleanliness. These results attest to the findings by numerous researchers who have reported that education and training enrich vendor's knowledge and approach to food safety practices (Alimi, 2016; Khairuzzman, Chowdhury, Zaman, Mamun & Bari, 2014; Mjoka & Selepe, 2017). Conversely, a study in India and China argue that education has no substantial influence on knowledge and attitude of vendors to food safety practices (Alimi, 2016; Ma et al., 2019). Whilst a study pertaining to safety training in primary schools in Malaysia noted relatable results. These findings stipulate that despite the knowledge and training, application of sanitation was still a primary concern (Husain, Muda, Jamil, Hanafi & Rahman, 2016).

Table 4. Food safety and hygiene knowledge

Variables	Managers % (n=15)	FH's % (n=39)
Wiping cloths can spread microorganisms?		
Yes	100.00 (n=15)	94.87 (n=37
The same cutting board can be used for raw foods and cooked foods		
Yes	33.33 (n=5)	46.15 (n=18)
Cooked foods does not need to be thoroughly reheated		
True	40.00 (n=6)	64.10 (n=25)
Cooked meat can be left out of the fridge to cool overnight before refrigerating		
True	33.33 (n=5)	56.41 (n=22)
Wash fruits and vegetables before eating / preparing		
True	100.00 (n=15)	100.00 (n=39)
Cooked foods should be kept very hot before serving		
True	100.00 (n=15)	92.31(n=36)
Safe water can be seen by the way it looks		
True	60.00 (n=9)	69.23 (n=27)
Thawing food can be done on the counter		
Agree	60.00 (n=9)	58.97 (n=23)
Frequent hand washing is advisable during food preparation?		
Agree	100.00 (n=15)	100.00 (n=39)
Raw food needs to be stored separately from cooked food?		
True	100.00 (n=15)	100.00 (n=39)
Food need to be inspected for freshness to ensure quality ingredients		
Agree	100.00 (n=15)	100.00 (n=39)
Food that has reached its expiry date must be thrown away		
Agree	100.00 (n=15)	100.00 (n=39)
Keeping kitchen surfaces clean reduces the risk of illness		
Agree	100.00 (n=15)	100.00 (n=39)
Keeping raw and cooked food separate helps prevent illness		
Agree	93.33 (n=14)	100.00 (n=39)
It is unsafe to leave cooked food out of the refrigerator for more than two hours		
Agree	86.67 (n=13)	87.18 (n=34)

Cleaning

Both managers and FH's positively indicated the availability of cleaning chemicals and tools, 100.00% (n=15) and 97.44% (n=38) respectively. Regarding the frequency of cleaning the utensils, 40.00% (n=6) of the managers indicated that utensils were cleaned after all the work was done, while 35.90% (n=14) of the FH's indicated that utensils were cleaned while food preparation was in progress. The results from the "Cleaning and the Preparation Area," question answered by both managers and FH's confirmed that the golden rule "Clean as you go" was not practised or was unknown. Forty percent (n=6) of the managers and 46.15% (n=18) of FH's indicated that the preparation area was cleaned after the food was ready. Furthermore, on the frequency of cleaning the stove, the majority of both the managers 53.33% (n=8) and the FH's 58.97% (n=23) indicated that the stove was cleaned after all the work was finished and this is evidence again that the golden rule was not practiced. Knowledge on how to clean cooking utensils, hand washing and sanitising of work areas was relatively good for both the

parties (Table 4). Research show that clean-as-you-go is one of the main principles to maintain food hygiene furthermore, the spread of foodborne illnesses is related to improper preparation and practice (Akabanda, Hlortsi & Owusu-Kwarteng, 2017; Mol, Akay & Guney, 2018).

Hygiene practices and food safety

It was discovered that in most of the vending premises FH's did not constantly and properly wash their hands (Table 5) with soap and use drying equipment. That was mainly because the bucket system (a small bucket of soapy water kept inside the stall) does not encourage frequent hand washing as much as a tap and sink does. These conditions were mirrored in related studies conducted by Kok and Balkaran (2014) and Muyanga et al., (2011). Furthermore, FH's did not wash hands after handling money, touching body parts, handling dirty utensils, garbage and before serving food. In most vending stalls, one person was in charge of collecting cash or swiping students' buying cards. The very same person was also responsible for handing over food to the customers. This acts highly compromises food safety and hygiene due to improper practice (Mol et al., 2018). Moreover, some of the food containers did not cover food completely, leaving it exposed to flying insects and dust. Another observation made was poor temperature control during food preparation and improper food holding temperatures. Food items were prepared well in advance and kept in containers. During service, it was slightly reheated and served. Additionally, during peak hours reheating time was often insufficient to destroy micro-organisms that might have been present in the food. Literature clearly states that keeping food at high and relatively humid temperatures for an extended period is a main cause of food poisoning (Paparella, Serio, Rossi, Mazzarino & López, 2018). Therefore, the current findings strengthen the need for food safety training to prevent food borne outbreaks.

Table 5. Observational findings on hygiene practises by FH's and students

Variables	Positive observation (Yes) % (n=15)
HYGIENE	
Are the kitchens utensils clean?	86.67(n=13)
Is the kitchen equipment clean?	73.33 (n=11)
Are the correct cleaning chemicals available?	93.33 (n=14)
Are there adequate cleaning supplies: cloths, scourers etc.?	100.00 (n=15)
Are the work areas clean?	73.33 (n=11)
Is the area cleaned frequently during preparation?	66.67 (n=10)
Is the area sanitised following food preparation?	33.33 (n=5)
Is there water available for cleaning?	93.33 (n=14)
Do the FH's wash their hands regularly	53.33 (n=8)
Is there water available for the FH's to wash hands?	80.00 (n=12)
Is there soap available for hand washing?	100.00 (n=15)
Are the food handlers clothes clean?	86.67 (n=13)
Do the servers wash their hands before serving?	40.00 (n=6)
Do the students wash their hands before eating?	100.00 (n=15) NO
Is cooked food kept separately from raw food items?	100.00 (n=15)

Proper store-room areas were not available in the majority of the vending stalls, and correct food storage procedures were not adhered to as displayed in (Table 6). Since most of the vending stalls were small, the storage area was very minimal. The managers brought stock

using cars every morning (Table 7) and some of the perishable stock was not covered properly during transportation. Furthermore, food temperatures were not properly checked when stock was received. Because of that, the cold chain that ensures that safe temperatures are kept at all times throughout transportation, storage, handling and cooking was broken. The mode of transport, food handling procedures and poor storage facilities exposed food items to contamination and the risk of bacterial growth. In addition, non-perishable stock was stored in different places such as shelves, cardboards, floors, on top of fridges and underneath work surfaces due to shortage of space. Only perishable food stock was stored in the prescribed manner in a refrigerator.

Table 6. Observational findings with regard to storage facilities

Variables	Positive observation (Yes) % (n=15)
STORAGE	
Is perishable food stored in a cold room/fridge?	100.00 (n=15)
Is non- perishable food stored in a separate room?	40.00 (n=6)
Are cleaning items stored with food?	13.33 (n=2)
Are the storage areas kept locked?	26.67 (n=4)
Is there adequate light in the storage area?	33.33 (n=5)
Is there adequate space in the storage area?	40.00 (n=6)
Is the food stored in original packaging?	86.67 (n=13)
Are the products clearly labelled?	86.67 (n=13)
Are there expiry dates on food items?	100.00 (n=15)
Have some food passed the expiry date?	100.00 (n=15) NO
If products are transferred to storage containers, is the expiry date recorded?	6.67 (n=1)
Any expired food items being used?	100.00 (n=15) NO
Are all containers covered?	73.33 (n=11)
Are there any old or stale food items?	100.00 (n=15) NO
Any evidence of decay in fresh produce?	100.00 (n=15) NO
Are the storage areas clean?	26.67 (n=4)
Are the storage areas neatly arranged?	33.33 (n=5)
Any food stored directly on the floor?	80.00 (n=12)
Is refrigerated storage available?	100.00 (n=15)
Is the stock sheet kept?	80.00 (n=12)
Is the old stock used before the new stock (FIFO)?	100.00 (n=15)
Any evidence of pest (rodents/insects) infestation?	26.67 (n=4)
Any unpleasant odours in the storage area.	46.67 (n=7) NO

FH's did not value the importance of basic principles of food safety such as ensuring that the correct temperature is maintained during food preparation and service (Table 6) and this could be attributed to insufficient space for food preparation and food service (Paparella et al., 2018).

Table 7. Receiving of goods

Variables	Managers % (n=15)
Are there formal contracts with the suppliers?	
Yes	53.33 (n=8)
Is there a planned delivery schedule?	
Yes	73.33 (n=11)
The person delivering the suppliers	
Commercial supplier	60.00 (n=9)
Commercial supplier & local member	6.67 (n=1)
Owner	33.33 (n=5)
How is the non – perishable food delivered?	
Closed truck	33.33 (n=5)
Car	66.67 (n=10
How is the perishable food delivered?	
Closed truck	13.33 (n=2)
Refrigerated truck	13.33 (n=2)
Car	73.33 (n=11)

It was also noted with concern that students did not wash their hands prior to eating food items purchased and most of the food items purchased were eaten by hands. Regular washing of hands is one of the precautionary measures of preventing food contamination and foodborne diseases as highlighted by the World Health Organisation (WHO, 2017). These observations reinforce the need for proper infrastructure around the food courtyard and personal hygiene awareness. Lastly, it became clear that a healthy style of living or concern for hygiene and food safety was not the student's main priority. All that matters is buying food that is relatively cheap and filling without considering the place where food is prepared or the nutritional value of the food item.

Conclusion

Hygiene and food safety research has proliferated over the years demonstrating that food vending is an important component to the socio-economy of developing countries and it will continue to grow due to its affordability and easy access. However, there is a paucity of studies that focus on the hygiene and food safety within parameters of tertiary environments and this research postulates that the informal nature of food vending give rise to unpleasant activities which could pose serious dangers to the health and safety of students, staff and the surrounding community. The results of the study revealed the urgent need for basic infrastructure such as a decent food kiosk with adequate working space, proper washing and storage facilities to improve food safety and hygienic practices. Furthermore, the literature revealed that even though food vendors claim to have received hygiene training, the knowledge attained was not effectively practiced or used. The findings of this study offers the relevant stakeholders of DUT to share in the solution in assisting food vendors with additional food safety knowledge and training, as well as creating an ongoing measurement programme based on the provided trainings that is carried out in an ad hoc manner. These assessments can be incorporated in student curricular for courses that include hygiene safety for example, Hospitality and Catering Management. Thus, promoting hygiene, safety and protection of university students and staff from foodborne diseases, as well as providing DUT with opportunities community outreach.

Despite this study being limited to food vendors selling to a single tertiary institution, intervention from DUT is advised for food vendors within their grounds. It is also recommended that government and municipalities develop suitable measures of food safety and hygiene policies, particularly for food vendors that supply universities within KwaZulu Natal. Considering the global Covid-19 pandemic where hygiene practice is essential, this paper provides evidence that guidelines would be beneficial for university food vendors in KwaZulu Natal and across South Africa. Although the limitation of this study was not including the street vendors outside DUT campuses, this paper still contributes to food safety and hygiene literature more specifically regarding food vendors which has been noted as a scarcity in both South Africa and amongst higher education institutions generally. Future research can consider the limitation of this study and assess the role external vendors play in university student's food intake patterns and food provision. In addition, the nutritional value that food vendors offer to the student and staff population within universities can also be evaluated.

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